FACT SHEET

FOR PART-TIME FARMERS AND GARDENERS

UNITED STATES DEPARTMENT OF AGRICULTURE

ANIMAL MANURE FOR CROP PRODUCTION

The recent trend toward specialized livestock and poultry operations has brought about many changes with respect to the economic value of manure and to the methods used in handling it. Establishing a dollar value for manure based solely on its chemical analysis is no longer valid. Numerous other factors, such as location, storage conditions, method of application, and cost of application must be considered in arriving at a true dollar value.

The situation is further complicated by the fact that the feedlot or poultry operation having a large amount of manure available may have a very limited amount of land on which to spread it. Or, because of weather or other influences, finding ideal conditions for spreading it may be difficult. To the operators with large quantities of manure, the overriding interest is disposing of it at reasonable cost rather than considering its economic value for crop production.

In spite of the many new uses proposed for animal manure, the bulk of manure produced will continue to be returned to the land and used for crop production. When this is done, questions arise as to rate of application, when to apply, nutritient values, etc. This guide is designed to help answer some of these questions.

Amount Produced by Farm Animals

The amount of manure produced by farm animals will vary with the size and age of animals, type of ration fed, and other factors. The amounts given in table 1 are rough averages for fresh manure of mature animals.

TABLE 1—AMOUNT OF FRESH MANURE PRODUCED BY FARM ANIMALS

Kind of animal	Manure produced		Water content
	daily	annually	
	Pounds	Tons	Percent
Beef	60	11.00	80
Dairy	70	13.00	84
Hogs	9	1.70	75
Horses	44	8.00	60
Sheep	4	0.72	65
Laying hens	0.30	0.05	75
Broilers	0.28	—	75
Turkeys	0.75	—	75

TABLE 2—PRIMARY NUTRIENTS IN FRESH ANIMAL MANURE

Kind of animal	Water content	Nitrogen (N)	Phosphate (P_2O_5)	Potash (K_2O)
	Percent	Pounds per ton		
Beef	80	14.0	9.0	11.0
Dairy	84	12.0	5.0	12.0
Horses	60	12.0	5.0	9.0
Hogs	75	10.0	7.0	13.0
Sheep	65	21.0	7.0	19.0
Laying hens	75	20.0	25.0	10.0
Broilers (litter)	30	56.0	46.0	36.0
Turkeys (litter)	30	26.0	15.0	10.0

TABLE 3—MICRONUTRIENTS IN ANIMAL MANURE

Kind of animal	Water content	B	Ca	Cu	Fe	Mg	Mn	Mo	S	Zn
	Percent	Pounds per ton								
Horses	60	.03	15.7	.01	.27	2.8	.02	.002	1.4	.03
Cattle	80	.03	5.6	.01	.08	2.2	.02	.002	1.0	.03
Sheep	65	.02	11.7	.01	.32	3.7	.02	.002	1.8	.05
Hogs	75	.08	11.4	.01	.56	1.6	.04	.002	2.7	.12
Laying hens	50	.12	74.0	.03	.93	5.8	.18	.011	6.2	.18
Broilers (litter)	30	.08	29.0	.06	2.00	8.4	.46	.007	—	.25

Nutrient Content of Animal Manure

The nutrient content of animal manure varies greatly. Figures in table 2 are for fresh manure under average conditions. Some factors that influence the nutrient substance of manure include: (1) How manure is stored, (2) length of storage, (3) percentage of moisture (4) how manure is spread and incorporated in the soil.

Nitrogen is the most valuable constituent of manure and also the most easily lost. The loss occurs through the volatilization of ammonia and through leaching by rainfall.

The phosphate content of manure is fairly stable. However, much of the potash can be lost through leaching. About 50 percent of the nitrogen in manure is available to crops the first year with the balance becoming available in subsequent seasons. Much greater portions of potash and phosphate are available the first year.

Manure contains numerous micronutrients essential to plant growth as indicated in table 3. Soils deficient in any of these nutrients would greatly benefit from the application of manure. Manure also adds humus to the soil and improves soil tilth. Assigning a dollar value to these benefits is very difficult, but the benefits exist and last for more than 1 year.

Nutrients in Liquid Manure

Many dairy, hog, and poultry farmers employ various systems in their use of liquid manure. In some instances, farmers can facilitate the handling of the manure and retain more of its plant food nutrients through use of these systems. But the systems also have serious drawbacks. One is the high cost of hauling a heavy, bulky product. Another is estimating its nutrient substance without a specific laboratory analysis.

For an accurate laboratory analysis of the manure's nutrient content, samples must be properly taken and preserved. If a specific laboratory analysis is not available, use tables 4 and 5 to determine the nutrient content since nonlaboratory analyses may vary considerably.

The nutrient content of lagoon effluent is also dependent upon a number of factors, including climate, loading rate, age of lagoon, kind of animals, type of ration being fed, and the amount of surface water entering the lagoon.

Table 5 gives some guidelines for different types of lagoons where the effluent is used through an irrigation system. The values are given in pounds per acre-inch.

TABLE 4—PRIMARY NUTRIENTS IN LIQUID MANURE

Kind of animal	Nitrogen (N)	Phosphate (P_2O_5)	Potash (K_2O)
	Pounds per 1,000 gallons		
Dairy	47.0	8.5	42.5
Beef	26.6	19.1	30.0
Swine	55.0	27.0	34.0
Poultry	64.0	28.0	59.0

TABLE 5—PRIMARY NUTRIENTS IN LAGOON EFFLUENT

Type of lagoon	Nitrogen (N)	Phosphate (P_2O_5)	Potash (K_2O)
	Pounds per acre-inch[1]		
Dairy	46	36	96
Swine	52	18	55
Poultry	57	18	—

[1] 1 acre-inch = 27,000 gallons.

How Much Manure To Apply

In most cases, commercial fertilizer will be needed in addition to manure to provide nitrogen, phosphate, and potash in the amounts required for good crop production.

Where sufficient manure is available to cover a substantial crop acreage, guessing on amounts of fertilizer needed can be hazardous. In such situations, a soil test and chemical analysis of the manure for nitrogen, phosphate, and potash are suggested. With this information, plus data in table 6, the amount of manure and fertilizer needed to grow specific crops can be calculated.

For a small acreage, a soil test along with the data in tables 2 and 6 may be used to calculate requirements. One procedure when using this method is to obtain the nitrogen needs from the manure; then if necessary, obtain any additional phosphate and potash needed from commercial fertilizer.

Example: A dairyman who has tested his soil and is fertilizing for a 120-bushel corn crop may calculate in the following manner:

1. From table 6—nutrients removed by 120-bushel corn crops (grain only removed)—96-44-24
2. From soil test—subtract nutrients available in the soil—48-10-120 (as example only)
3. Amount to be supplied through manure and fertilizer—48-34-0
4. From table 2—application of 8 tons of dairy manure will supply 96-40-96 (one-half of nitrogen is available to crop for first year; phosphate and potash equal to a like amount of fertilizer)—48-20-49
5. Amount to be supplied through chemical fertilizer—0-14-0

TABLE 6—NUTRIENTS REMOVED BY VARIOUS CROPS

Crop	Yield	Part of crop	Nitrogen (N)	Phosphate (P_2O_5)	Potash (K_2O)
			Pounds		
Corn	80 bu	grain	64	29	16
	1,120 lb	cobs	4	1	11
	2.5 ton	stalks	47	10	89
Total			115	40	116
Milo	70 bu	grain	61	23	15
	2 ton	stalks	20	10	62
Total			81	33	77
Alfalfa[1]	4 ton	all	196	44	189
Red clover[1]	2 ton	all	77	18	79
Lespedeza[1]	2 ton	all	92	18	51
Orchard grass	2.5 ton	all	65	21	115
Timothy grass	2.5 ton	all	53	16	95
Reed Canary grass[2]	6.1 ton	all	359	82	360
Fescue[3]	5 ton	all	275	60	325

[1]Legume crop. Approximately 70 percent of the nitrogen in inoculated legumes is fixed from the air. Data in these tables were obtained from Morrison, N.P.F.I., and other sources. [2]Reed canary grass normally will remove 40-50 pounds of nitrogen per ton of dry matter from healthy, mature plants, and 60 pounds of nitrogen per ton when harvested in the black-green, fast growth stage. Paris, Texas, and Ames, Iowa, report nitrogen cropping removals of 361 and 400 pounds per season, respectively. Reed canary grass normally will remove 40 pounds of K_2O per ton of dry matter, but will remove up to 80 pounds per ton if that is available. Phosphorus removal is normally between 12 and 15 pounds per ton of dry matter. [3]Fescue will remove 45-75 pounds of nitrogen per ton of dry matter, with the highest amount of removal when the crop is harvested shortly after heading, while the stems are green. Potash removal will normally average 65 pounds per ton.

Application on Forage and Grain Crops

Manure can be a valuable source of fertilizer for forage crops if used on the right species and applied at the proper time and rate.

Alfalfa or grass-legume combinations respond very little to applications of manure unless the soil is very low in phosphorus and potassium. In one test, 100 tons of manure per acre increased alfalfa-orchard grass yields less than 0.4 tons annually. Legumes respond very little to applied nitrogen. In addition, large amounts of manure can stimulate grasses to the extent that legumes are crowded out of the stand.

Heavy applications of manure should not be made on land prior to making a new seeding. Excessive nitrogen at seeding time stimulates weed growth more than it does the growth of seedlings. However, small amounts such as 3 to 5 tons per acre can be disked into soil with beneficial results.

The greatest response of forage crops to manure occurs when manure is applied to predominantly grass sods.

Grass responds vigorously to the nitrogen in manure. The best time to apply manure to grass sod is during winter or early spring. Relatively heavy amounts can be applied without smothering the grass stand. In tests, one application of 20 to 25 tons of caged layer manure was applied per acre without excessive runoff and without smothering the grass stand. Continuous applications at this rate could lead to pollution problems and toxic forage.

If manure is spread on forage crops during the growing season much smaller amounts, such as 5 to 10 tons per acre, should be used to prevent damage to the growing plants.

On land for growing corn, apply manure as far in advance of planting as possible. Apply it in late fall or winter and plow under. If applied in the spring after plowing, disk it in the soil immediately.

For small grain crops, manure may be broadcast and plowed down or disked in before seeding time. Or, it may be used as a light top dressing in February or March.

Using Manure on Horticultural Crops

Commercial Vegetables. Manure can be profitably used on many commercial vegetable gardens. The long-term soil tilth benefits and addition of nutrients can improve both yields and quality of vegetables on most soils. Composted manure is the safest to use as it is less likely to introduce troublesome weeds in vegetable plantings. Avoid planting potatoes and most root crops on newly manured vegetable ground.

Commercial Fruit. Manure has limited use in the production of commercial fruit. Weeds can be a problem in growing strawberries. Erratic and late release of nitrogen can be a problem in growing fruits and grapes. The best use of manure would be on new orchard vineyard plantings prior to establishment.

Home Gardens. Composted manure is the best to use on home gardens to avoid excessive weeds. A layer of well-composted manure 1 to 2 inches deep can be applied any time and plowed or tilled into the soil.

Where fresh livestock manure is available, apply only in the fall of the year at a rate not to exceed 10 tons per acre (50 lb/1,000 ft^2) and plow under. For poultry manure, use half the livestock manure rate. Avoid planting potatoes or root crops on freshly manured ground—wait at least a year.

Precautions In Using Manure

Tests have shown that too much manure can be applied to land for crop production. The maximum rate depends on soil type, frequency of application, and crop to be grown.

On fields where manure is used every year, application for grain crops should be limited to the tonnage required to provide the nitrogen needs of the current crop as determined by soil test. For most crops, 5 to 12 tons of livestock manure will go a long way toward meeting this need. Less will be required if poultry manure is used.

Applications that provide nitrogen in excess of actual requirements can, if continued annually, contribute to increased nitrate levels in surface or ground water supplies. Other management problems may also be complicated by excessive applications. Because commercial fertilizer will be needed in addition to manure, apply manure over a larger acreage at a reduced rate rather than at the maximum rate on a smaller acreage.

Too much manure can smother grass stands and reduce yields. It will cause small grains to lodge. It may also create other problems such as nitrate toxicity, grass tetany, and fat necrosis in grazing animals. The buildup of copper, arsenic, boron, zinc, and heavy metals and salts in the soil may reach toxic levels in plants grown on soils that are heavily manured in excess of 12 tons per year.

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United States Department of Agriculture
Office of Communication
Washington, D.C. 20250

Written by:
Extension Specialists
College of Agriculture
University of Missouri